

Claims

1. Method for determining a transmission power factor being operable with an i-th re-transmission during an uplink data transmission between a mobile terminal device (UE) and a base station (BS) via a code division multiple access (CDMA) system employing an automatic repeat request (ARQ), said uplink data transmission being operated in a sequence of first transmissions and i-th re-transmissions,
- receiving a pre-defined number (M) of status information items, said status information items each containing at least one of an acknowledgement (ACK) item and a non-acknowledgement (NACK) item in accordance with said automatic repeat request (ARQ);
 - determining a first error quantity (N_i) and a second error quantity (K_i) from said pre-defined number (M) of status information items, said first error quantity (N_i) being equal to a number of i-th re-transmissions, said second error quantity (K_i) being equal to a number of i-th re-transmissions being responded by status information items each containing said non-acknowledgement (NACK) item; and
 - determining an error ratio from said first error quantity (N_i) and said second error quantity (K_i); and
 - determining a transmission power factor ($P_{i_cmd, new}$) from a current valid transmission power factor (P_{i_cmd}) and a transmission power correction factor (ΔP_{i_cmd}) such that a difference between said error ratio and a pre-defined target error ratio (FER) is minimized.
2. Method according to claim 1, wherein said determining of the transmission power factor further comprises :
- determining a deviation value of said error ratio from a pre-defined target error ratio (FER);
- in case said first error quantity (N_i) is unequal to zero or said deviation value exceeds a pre-defined deviation level :
- determining said transmission power correction factor (ΔP_{i_cmd}) depending on at least a transmission power correction step value (ΔP_{i_step}), said first error quantity (N_i), said second error quantity (K_i) and said pre-defined target error ratio (FER); and
 - determining said transmission power factor ($P_{i_cmd, new}$);
- otherwise:
- maintaining a current valid transmission power factor (P_{i_cmd}) being operable with said i-th re-transmission.

- 3.. Method according to claim 2, wherein said transmission power correction factor (ΔP_{i_cmd}) increases said transmission power factor (P_{i_cmd}) in case said error ratio is higher than said pre-defined target error ratio (FER) and said transmission power correction factor (ΔP_{i_cmd}) decreases said transmission power factor (P_{i_cmd}) in case said error ratio is lower than said pre-defined target error ratio (FER).
4. Method according to any one of the preceding claims, wherein said error ratio (K_i/N_i) is a ratio of said second error quantity (K_i) and said first error quantity (N_i).
5. Method according to any one of the claim 2 to 4, wherein said deviation value is an absolute deviation value of a difference between said error ratio (K_i/N_i) and said pre-defined target error ratio (FER) and said pre-defined deviation level is a pre-defined system parameter (ϵ).
6. Method according to any one of the claim 2 to 5, wherein said pre-defined deviation level depends (ϵ) on said pre-defined target error ratio ($\epsilon = \epsilon[FER]$).
7. Method according to any one of the claim 2 to 5, said transmission power factor (P_{i_cmd}) being a transmission power reduction factor, said transmission power factor (P_{i_cmd}) being defined in relationship to a transmission power being operable with first transmissions, wherein said transmission power is an original transmission power being not adjusted due to one or more further supplementary power control mechanisms.
8. Method according to any one of the preceding claims, wherein said pre-defined target error ratio is a target frame error ratio (target FER).
9. Method according to any one of the claim 2 to 7, wherein said transmission power correction factor (ΔP_{i_cmd}) is a product of a first factor, a second factor and a third factor, wherein
- a value of said first factor is equal to a value out of -1 and +1;
 - said second factor is defined mathematically as following:

$$\left(\frac{C_{N_i}^{K_i} \cdot FER^{K_i} (1 - FER)^{N_i - K_i}}{FER} \right)^{-1}$$

where $C_{N_i}^{K_i}$ is a binomial coefficient, FER is said pre-defined target error ratio (FER), N_i is said first error quantity (N_i) and K_i is said second error quantity (K_i); and

- said third factor is said transmission power correction step value (ΔP_{i_step}).

10. Method according to any one of the preceding claims, wherein said code division multiple access (CDMA) system is a wideband code division multiple access (WCDMA) system, said automatic repeat request (ARQ) is a fast hybrid automatic repeat request (fast H-ARQ), at least one dedicated physical data channel (DPDCH) and a dedicated physical control channel (DPCCH) are used for uplink data transmission WCDMA and said transmission power factor (P_{cmd}) is applied selectively on said at least one dedicated physical data channel (DPDCH).
11. Software tool for determining a transmission power factor, comprising program portions for carrying out the operations of any one of the claims 1 to 10, when said program is implemented in a computer program for being executed on a processing device, a terminal device, a communication terminal device or a network device.
12. Computer program product for determining a transmission power factor, comprising loadable program code sections for carrying out the operations of any one of the claims 1 to 10, when said computer program is executed on a processing device, a terminal device, a communication terminal device or a network device.
13. Computer program product for determining a transmission power factor, wherein said computer program product is comprising program code sections stored on a computer readable medium for carrying out the method of any one of the claims 1 to 10, when said computer program product is executed on a processing device, a terminal device, a communication terminal device or a network device.
14. Mobile terminal device for determining a transmission power factor being operable with an i -th re-transmission during an uplink data transmission to a base station (BS), comprising:
- a communication interface,
said communication interface transmitting a sequence of individual data packets, said transmitting being operated via a code division multiple access (CDMA) system and using an automatic repeat request (ARQ),
said communication interface receiving a pre-defined number (M) of status information items each containing at least one of an acknowledgement (ACK) item and a non-acknowledgement (NACK) item in accordance with said automatic repeat request (ARQ);
 - a component for determining a first error quantity (N_i) and a second error quantity (K_i) from said pre-defined number (M) of status information items,
said first error quantity (N_i) being equal to a number of i -th re-transmissions,

said second error quantity (K_i) being equal to a number of i -th re-transmissions being responded by status information items each containing said non-acknowledgement (NACK) item;

- a component for determining an error ratio from said first error quantity (N_i) and said second error quantity (K_i); and
- a component for determining a transmission power factor ($P_{i_{cmd,new}}$) from a current valid transmission power factor ($P_{i_{cmd}}$) and a transmission power correction factor ($\Delta P_{i_{cmd}}$) in order to minimize a difference between said error ratio and a pre-defined target error ratio (FER).

15. System allowing for determining a transmission power factor being operable with an i -th re-transmission during an uplink data transmission from a mobile terminal device (UE) to a base station (BS),

said mobile terminal device comprising:

- a communication interface,
said communication interface transmitting a sequence of individual data packets, said transmitting being operated via a code division multiple access (CDMA) system and using an automatic repeat request (ARQ),
said communication interface receiving a pre-defined number (M) of status information items each containing at least one of an acknowledgement (ACK) item and a non-acknowledgement (NACK) item in accordance with said automatic repeat request (ARQ);
- a component for determining a first error quantity (N_i) and a second error quantity (K_i) from said pre-defined number (M) of status information items,
said first error quantity (N_i) being equal to a number of i -th re-transmissions,
said second error quantity (K_i) being equal to a number of i -th re-transmissions being responded by status information items each containing said non-acknowledgement (NACK) item;
- a component for determining an error ratio from said first error quantity (N_i) and said second error quantity (K_i); and
- a component for determining a transmission power factor ($P_{i_{cmd,new}}$) from a current valid transmission power factor ($P_{i_{cmd}}$) and a transmission power correction factor ($\Delta P_{i_{cmd}}$) in order to minimize a difference between said error ratio and a pre-defined target error ratio (FER);

said base station comprising:

- a communication interface,

said communication interface receiving said sequence of individual data packets from said mobile terminal device; and

said communication interface transmitting said status information items to said mobile terminal device, said status information items being based on said automatic repeat request (ARQ).